DOCUMENT RESUME

ED 161 501 JC 780 581

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TITLE The Statistical Predictability of the Academic Performance of Registered Nursing Students at Macomb. Project No. 0141-77.
INSTITUTION Macomb County Community Coll., Warren, Mich.
PUB DATE Oct 77
NOTE 43p.

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Academic Achievement; Academic Records; Age; Associate Degrees; Community Colleges; Correlation; Females; Grade Point Average; Grade Prediction; Health Occupations Education; *Junior Colleges; Males; *Nursing; *Predictive Measurement; State Licensing Boards; *Student Characteristics

ABSTRACT

A study was conducted at Macomb County Community College to determine whether there was a significant relationship between grades earned in individual nursing courses and the scores earned on corresponding subsets of the state board exam for nursing graduates and also whether a nursing student's success could be predicted from admissions characteristics. The study population (N=130) included all students enrolled in Nursing 101 in fall 1974, together with all Macomb nursing graduates who took the state board in July 1976. Linear relationships were computed for the following variables: sex, marital status, age, composite American College Testing Program (ACT) score, high school biology grade, high school math grade, high school grade point average (GPA), college-level anatomy and physiology grades, and overall achievement measures including the fact of graduation or non-graduation, average score earned in the state board exam, and final GPA earned at Macomb. Significant relationships include the following: graduation of a female student could be predicted using her final grade point average in high school or the grade earned in college-level anatomy or physiology; a student's scores on the state board exam could be predicted using grades earned in individual courses, or, for female students, using her anatomy and physiology grade, final GPA at Macomb, ACT score, marital status, or age; and female students' final GPA could be predicted using high school GPA or anatomy grades. (Author/MB)

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MACOMB COUNTY COMMUNITY COLLEGE

# The Statistical Predictability of the Academic Performance of Registered Nursing Students at Macomb

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JC 780 581

Department of Research

MACOMB COUNTY COMMUNITY COLLEGE

DEPARTMENT OF RESEARCH

# The Statistical Predictability of the Academic Performance of Registered Nursing Students at Macomb

Mary Jo Stankovich
October 1977
Project No. 0141-77

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ABSTRACT

This is a study of students who tried to earn the Asscciate Degree in Nursing at Macomb County Community College. Most of these students were enrolled in Fall 1974 and graduated in Spring 1976. Facts known when they registered and others recorded while they were enrolled were considered to see whether or not a student's achievement was predictable.

Facts considered included sex, age, marital status, ACT scores, high school grades and grades earned in college-level courses. Measures of achievement included graduation, results of the state nursing examination and final grade point averages.

Comparisons were made using the formula for the Pearson Product-Moment Coefficient of Correlation. Significant relationships were discovered for the following comparisons:

1. Graduation of a female student could be predicted using her final grade point average in high school or the grade she earned in college-level anatomy and physiology.
2. It was possible to predict a student's scores on the state nursing examination using grades earned in individual nursing courses at Macomb, or, for female students, using her grade for college-level anatomy and physiology, her final grade point average at Macomb, her composite ACT score, her marital status, or her age.
3. Female students' final grade point averages could be predicted using high school grade point averages or grades earned for college-level anatomy and physiology.

These predictions of achievement were made using linear regression formulas.

## INTRODUCTION

In the fall of 1976, Dr. Sam Petros, Associate Dean of Allied Health, asked the Research Department to conduct a study to answer the following questions:

1. Does a significant relationship exist between admissions characteristics of nursing graduates at Macomb and their performance at Macomb?
2. Does a significant relationship exist between admissions characteristics of nursing graduates at Macomb and their performance on the state board examination for nursing graduates?
3. Does a significant relationship exist between admissions characteristics of nursing graduates and nursing non-graduates at Macomb?
4. Does a significant relationship exist between grades earned in individual nursing courses at Macomb and scores earned on corresponding subtests of the state board examination for nursing graduates?

Other studies have been made regarding similar questions at various institutions.

## RELATED STUDIES

In 1975, Wayne County Community College completed a project entitled: "The Development and Testing of New Entrance Criteria for Nursing."[1] The main purpose outlined in that project was to determine whether traditional admissions criteria were essential in predicting success of nursing graduates. The conclusions of the study indicate that this is not the case.

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[1]Della Goodwin and Rosemary Mullick. The Development and Testing of New Entrance Criteria for Nursing. Detroit, Michigan: Wayne County Community College, 1975.

In 1973 Delta College conducted a study[2] to evaluate its nursing graduates and to determine, if possible, predictive factors for success. Success in this instance was measured principally in terms of job performance. The results of that study indicated no significant relationship between the admissions factors and success in terms of job performance.

In 1968 Dr. James W. Keene conducted a follow-up study[3] of nursing students enrolled at Foothill College in California. Dr. Keene examined the admissions characteristics of the classes of 1966 and 1967 and sought to compare this data with three success factors: (1) the fact of graduation or non-graduation, (2) scores obtained on the state licensing examination, and (3) job satisfaction as reported by graduates. Results of the study indicated that persons having a high school grade point average below 2.0 and a composite ACT score below 15 were poor risks.

In all of these studies, job performance or satisfaction was considered a chief criterion of success. This factor seemed extremely difficult to define, measure or evaluate.

For this reason, this study is directed toward success factors that are easier to evaluate.

## COMPARISONS

In order to find answers to the four questions posed in the introduction, this study was divided into two parts.

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[2]Barry J. Wilson, Crystal M. Lange and Glen E. Pockwood. "The Job Performance of Nursing Graduates: A Program Evaluation." Community Junior College Research Quarterly 1-2 (January-March 1977): 191-203.

[3]James W. Keene, A Follow-Up Study of the Registered Nursing Program. (Cupertino, California: ERIC Document Reproduction Service, ED 022 432, May 29, 1968).

Part One

The first part of the study is an attempt to provide an answer to the fourth question outlined in the introduction, i.e., does a significant relationship exist between grades earned in individual nursing courses at Macomb and scores earned on corresponding subtests of the state board examination for nursing graduates?

The first task was to determine which particular nursing courses at Macomb correspond to individual subtests in the state board examination.

The National League for Nursing, Inc., designates the subtests for the state board examination as follows:

1. MED NSG (Medical Nursing)
2. PSY NSG (Psychiatric Nursing)
3. OBS NSG (Obstetrical Nursing)
4. SURG NSG (Surgical Nursing)
5. NSG CHL (Nursing of Children)

A conversation with Gladys Weiss, Director of Nursing at Macomb, revealed the following set of correspondences between nursing courses at Macomb and the subtests of the state board examination:

1. The state board subtest for Nursing of Children corresponds to Nursing 104 at Macomb.
2. The state board subtest for Obstetrical Nursing corresponds to Nursing 206 at Macomb.

The subtests for Medical Nursing, Psychiatric Nursing and Surgical Nursing do not correspond to any particular nursing courses at Macomb.

However, according to Ms. Weiss, if these three subtests are considered as a whole, they do correspond to a group of three nursing courses at Macomb, when considered as a whole. They are:

1. Nursing 105
2. Nursing 204
3. Nursing 205

The method used to consider the state board and Macomb groups "as a whole" was, simply, a determination of two averages for each nursing graduate at Macomb as follows:

1. The grade point average for Nursing 105, Nursing 204, and Nursing 205.
2. The average of the three scores earned on the state board examination subtests for Medical Nursing, Psychiatric Nursing and Surgical Nursing.

The second task was determining whether a significant relationship existed between the grade point average for the three Macomb nursing courses, and the average of the three scores earned on the subtests.

One measure of the extent of linear relationship is the Pearson Product-moment Correlation Coefficient (Pearson R). This coefficient is a number whose absolute value lies between 0 and 1. If the absolute value of this number is greater than four-tenth (0.4), it is generally agreed that a significant linear relationship exists.

The formula for determining the value of the Pearson R was applied to those sets of data which corresponded to each other. The results are indicated in Table 1.

TABLE 1

Nursing Graduates
Comparisons between Grades Earned in Specific Nursing Courses
at Macomb and Scores Earned on Corresponding Subtests
of the State Board Examination

| Independent Variable | Mean | Standard Deviation | Dependent Variable | Mean | Standard Deviation | Pearson R | Significance Level | N |
|---|---|---|---|---|---|---|---|---|
| Grade earned in Nursing 104 at Macomb | 3.59 | .54 | Score on State Board Exam Subtest OBS NSG | 525 | 98 | .45 | Greater than .999 | 93 |
| Grade earned in Nursing 206 at Macomb | 3.28 | .61 | Score on State Board Exam Subtest NSG CHL | 583 | 94 | .41 | Greater than .999 | 93 |
| Macomb GPA for Nursing 105, Nursing 204, and Nursing 205 | 3.20 | .52 | Average Score on State Board Exam for Subtests MED NSG, PSY NSG, and SURG NSG | 535 | 90 | .63 | Greater than .999 | 94 |

The values of the Pearson R are greater than .4 in all three cases as shown above. This indicates a significant linear relationship between grades earned in individual nursing courses at Macomb and scores earned on corresponding subtests in the state examination.

The mean and the standard deviation for each set of raw scores were also determined as by-products in the application of the Pearson R formula. This additional information is also included in Table 1.

Part Two

The second part of this study addresses itself to finding answers to the first three questions posed in the introduction.

All three of these questions evolve from a larger question, namely, can a nursing student's success be predicted from his/her admissions characteristics?

The first problem encountered in answering this larger question was determining which characteristics of students admitted to the nursing program should be studied.

Dr. Sam Petros, Associate Dean of Allied Health, who initiated this study, recommended that the following admissions characteristics of nursing students be chosen for analysis:

1. Sex
2. Marital Status
3. Age
4. Composite American College Testing Program (ACT) Score
5. High School Biology Grade
6. High School Math Grade
7. High School Grade Point Average
8. College-level Anatomy and Physiology Grade

The last of these items, the grade earned in college-level anatomy and physiology, is not, strictly speaking, an admissions characteristic. While successful completion of this course is not required for admission to the nursing program at Macomb, it must be taken prior to or in conjunction with the first nursing course in the program.

For this reason, Dr. Petros desired its inclusion.

The next task was to identify some ways of measuring success at Macomb.

One measure of success at Macomb is the fact of graduation from the program. A second measure of success is derived by averaging the students' scores on the five subtests of the state nursing examination. This measure enables the performance of one student to be compared with that of any other. A third measure of success is the grade point average earned at Macomb by each student. This measure, too, allows the achievement of each student to be compared with that of the others.

This threefold method of measuring success of nursing students evolved naturally from the data.

## The Data

Data, as available, were found in five major sources.

A report issued by the State of Michigan in July, 1976 provided the scores earned on all five subtests of the most recently administered state board examination for those graduates of the nursing program at Macomb County Community College who chose to take the examination at that time.

The Class Roster Report for Fall 1974 provided the names and social security numbers of all students enrolled in Nursing 101 during that semester.

The file containing transcripts provided the final grade point average attained at Macomb, grades earned in any course in which a student enrolled at Macomb, a transcript of courses taken at other post-secondary institutions, and the student's birthdate.

Individual student admissions files were examined for the grades earned in high school biology and math courses, the final grade point average earned in high school, marital status, sex, and the composite ACT score.

These files could not be located for 38 percent of the students in the study. Of those found, 35 percent contained all of the information sought. Of the remaining 65 percent, some but not all, of the data were found.

For this reason, the computer data base containing individual student records was searched for the data that could not be found in the student admissions files. A very small portion of the missing data was recovered in this manner. Most of the information sought in the computer data base was missing from the student records.

The availability of data determined the size and extent of the population for study.

## The Population

The population included all persons in each of two separate categories: (1) all students enrolled in Nursing 101 in the Fall of 1974, together with (2) all Macomb nursing graduates who took the state board examination in July, 1976.

It was possible for a person to belong to either of these two categories without belonging to the other.

One hundred-fourteen students were listed in the class roster under Nursing 101 in the Fall of 1974. Ninety-five Macomb graduates took the state board examination for nursing in July of 1976. The combined groups totaled 130 persons. A demographic breakdown of the population is shown in Table 2.

TABLE 2

Demographic Breakdown of Population

| Variable | Category | Number in Study | Percent of Total |
|---|---|---|---|
| Sex | Male | 10 | 8% |
| | Female | 120 | 92% |
| | TOTAL | 130 | 100% |
| Marital Status | Married | 56 | 43% |
| | Single | 46 | 35% |
| | Marital Status Not Known | 28 | 22% |
| | TOTAL | 130 | 100% |
| Age in Years as of September 1974[1] | 0 - 20 | 39 | 30% |
| | 21 - 25 | 29 | 23% |
| | 26 - 30 | 16 | 12% |
| | 31 - 35 | 21 | 16% |
| | 36 - 40 | 16 | 12% |
| | 41 and over | 9 | 7% |
| | TOTAL | 130 | 100% |

It is apparent from Table 2 that the number of males in the population is too small for independent analysis. It was postulated that including the males in the final analysis could obscure results peculiar to the females. The resulting population for analysis was comprised of the 120 females taken from the original population.

[1]Rounded to nearest year.

## Measures of Relationships

As indicated by other studies, the most effective statistical tool for determining the extent to which several variables are related or inter-related in a study of this type is the Multiple Regression Formula. This formula could not be used for purposes of this study because all of the data concerning admissions characteristics for each person were not available.

Consequently, the Pearson R was chosen. Each of the eight admissions characteristics (when available) was compared with each of the three success factors. The Pearson R was computed for each of twenty-four sets of paired data. If a particular admissions characteristic for a particular student was not available, that student was eliminated from that particular analysis of paired scores. For example, the marital status was not available for 25 females in the population chosen for study. When the Pearson R was computed for marital status, as compared with the success factor defined as a student's graduation, ninety-five pairs of scores were used to measure the degree of linear relationship.

The Pearson R demonstrates quantitatively whether or not a significant linear relationship exists between two sets of data. The value of the coefficient will not show that two sets of data are <u>not</u> related, but only that they are not related in a linear fashion. A significant linear relationship is indicated whenever the absolute value of the Pearson R is greater than, or equal to, four-tenths (0.4).

## Analysis of the Data

Admissions characteristics and measures of success were sought for each of the 130 persons in this study. In only twenty-seven of the 130 cases were all eleven items of information available:

1. Sex
2. Marital Status

3. Age
4. Composite ACT Score
5. High School Biology Grade
6. High School Math Grade
7. High School Grade Point Average
8. College Level Anatomy and Physiology Grade
9. The Fact of Graduation or Non-Graduation
10. The Average Score Earned in the State Board Examination.
11. The Final Grade Point Average Earned at Macomb.

Ten of these items were treated as variables for purposes of analysis and values were assigned to each.

Since the population chosen for detailed analysis was comprised entirely of females, sex was not variable.

Three variables were considered to be discrete and were assigned values as indicated in Table 3. Eight variables were considered to be continuous and were assigned values as indicated in Table 4.

TABLE 3

Values Assigned to Discrete Variables

| Variable | Values Assigned |
|---|---|
| Age | Individuals were assigned to an age range in years rounded to the nearest tenth. |
| Marital Status | Married persons were assigned the value of one; single persons were assigned the value of zero. |
| The Fact of Graduation or Non-Graduation | Graduates were assigned the value of one; non-graduates, zero. |

TABLE 4

Values Assigned to Continuous Variables

| Variable | Values Assigned |
|---|---|
| Age (treated both as a discrete and as a continuous variable) | Age was measured in years as of September, 1974, rounded to the nearest tenth and assigned the face value. |
| Composite ACT Scores<br><br>Average Scores Earned on the State Board Examination | These variables were assigned their face values. |
| High School Biology Grades<br><br>High School Math Grades<br><br>College-Level Anatomy and Physiology Grades | These grades were assigned the following values:<br>4 for the grade, A<br>3 for the grade, B<br>2 for the grade, C<br>1 for the grade, D, and<br>0 for grades below D. |
| Final Grade Point Average Earned in High School<br><br>Final Grade Point Average Earned at Macomb | These variables were assigned their face values rounded to the nearest hundredth. |

The means and standard deviations for the continuous variables are shown in Table 5.

TABLE 5

Female Nursing Students

Means and Standard

Deviations for

Continuous Variables

| Variable | Mean | Standard Deviation |
|---|---|---|
| Age | 27.53 | 8.65 |
| Composite ACT Score | 15.10 | 5.58 |
| Grade Earned in High School Biology | 2.63 | 0.88 |
| Grade Earned in High School Math | 2.93 | 0.96 |
| High School Grade Point Average | 2.93 | 0.65 |
| Grade Earned in College-Level Anatomy and Physiology | 2.72 | 0.84 |
| Average Score on the State Board Examination | 546.81 | 87.34 |
| Final Grade Point Average Earned at Macomb | 3.32 | 0.47 |

Frequency counts and frequency distributions for the discrete variables, marital status, age, and the fact of graduation or non-graduation are shown in Tables 6 and 7.

TABLE 6

Comparisons Between Married and Single Female Nursing Students

| Marital Status | Number in Study | Number Graduated | Percent Graduated |
|---|---|---|---|
| Married | 56 | 48 | 86% |
| Single | 38 | 25 | 66% |
| Marital Status not Known | 26 | 17 | 65% |
| TOTAL | 120 | 90 | 75% |

TABLE 7

Comparisons Between Various Age Groups of Female Nursing Students

| Age in Years as of September, 1974[1] | Number in Study | Number Graduated | Percent Graduated |
|---|---|---|---|
| 0 - 20 | 39 | 27 | 69% |
| 21 - 25 | 24 | 16 | 67% |
| 26 - 30 | 12 | 9 | 75% |
| 31 - 35 | 20 | 18 | 90% |
| 36 - 40 | 16 | 14 | 88% |
| 41 and over | 9 | 6 | 67% |
| TOTAL | 120 | 90 | 75% |

[1]Rounded to nearest year.

All of the variables, discrete and continuous, were compared using the Pearson R.

If a nursing student's success is measured in terms of graduation or non-graduation, this measure of success in linearly related to the high school grade point average (.35 rounds to .4) and also to the grade earned in college-level anatomy and physiology. (See Table 8)

TABLE 8

Female Nursing Students

Comparisons Between Admissions Characteristics and the Fact of Graduation or Non-Graduation

| Pearson R | Significance Level | N | Independent Variable |
|---|---|---|---|
| .35 | Greater than .99 | 76 | High School grade point average |
| .25 | Greater than .95 | 95 | Marital status |
| .12 | Less than .95 | 120 | Age, in years, as of September, 1974 (Rounded to nearest year) |
| .14 | Less than .95 | 49 | Composite ACT Score |
| .26 | Greater than .95 | 75 | Grade earned in High School Biology |
| .21 | Less than .95 | 80 | Grade earned in ANY High School Math course |
| .52 | Greater than .999 | 111 | Grade earned in College-level Anatomy and Physiology |

The higher a student's high school grade point average, or her grade in the college-level course in anatomy and physiology, the greater the probability that the student will graduate.

If a nursing student's success is measured in terms of the average score earned on the state nursing examination, Table 9 shows that success is linearly related to five characteristics: (1) marital status, (2) age, (3) composite ACT score, (4) the grade earned in college-level anatomy and physiology, and (5) the grade point average earned at Macomb.

Consequently, a married student is apt to earn a higher average score on the state nursing examination than a single student. Similarly, the older a student, the higher her average score should be. Also, the higher the student's composite ACT score, or her grade in college-level anatomy and physiology, or her final grade point average at Macomb, the higher her average score on the state examination will be.

TABLE 9

Female Nursing Graduates

Comparisons between Admissions Characteristics and the Average Score Earned on the State Board Examination

| Pearson R | Significance Level | N | Independent Variable |
|---|---|---|---|
| .25 | Less than .95 | 60 | High School grade point average |
| .41 | Greater than .999 | 73 | Marital status |
| .36 | Greater than .999 | 89 | Age, in years, as of September, 1974 |
| .38 | Greater than .95 | 31 | Composite ACT Score |
| .05 | Less than .95 | 60 | Grade earned in High School Biology |
| .53 | Greater than .999 | 87 | Grade earned in College-level Anatomy and Physiology |
| .09 | Less than .95 | 62 | Grade earned in ANY High School Mathematics Course |
| .68 | Greater than .999 | 95 | Macomb grade point average |

If a nursing student's success is measured in terms of the final grade point average earned at Macomb, Table 10 shows that success in this sense is linearly related to two admissions characteristics: the high school grade point average and the grade earned in college-level anatomy and physiology.

TABLE 10

Female Nursing Graduates

Comparisons Between Admissions Characteristics and Final Grade Point Average Earned at Macomb

| Pearson R | Significance Level | N | Independent Variable |
|---|---|---|---|
| .59 | Greater than .999 | 60 | High School grade point average |
| .24 | Greater than .95 | 73 | Marital Status |
| .14 | Less than .95 | 89 | Age, in years, as of September, 1974 (Rounded to the nearest year) |
| .15 | Less than .95 | 31 | Composite ACT Score |
| .16 | Less than .95 | 60 | Grade earned in High School Biology |
| .72 | Greater than .999 | 87 | Grade earned in College-level Anatomy and Physiology |
| .21 | Less than .95 | 62 | Grade earned in ANY High School Math course |

## CONCLUSIONS

Once a significant linear relationship is established between two variables, one of which is continuous, prediction of one, based on the other, is possible using a linear regression formula.

Linear regression formulas were applied to those variables that were significantly related to either the average score earned on the state examination or to the final grade point average earned at Macomb.

For each of these situations, some or all of the following information is provided:

1. The Regression Formula.
2. The Standard Error of the Estimate.
3. Selected Values for the Independent Variable.
4. Predictions of Minimum and Maximum Achievement.
5. Probabilities of Attaining Specific Levels of Achievement.

There is an 84 percent chance that a student's actual achievement will be at or above the minimum level and an equal likelihood that the actual achievement will be at or below the maximum level. The ranges are determined using the standard error of the estimate.

The grade earned in Nursing 104 can be used to predict the minimum or maximum score a nursing graduate is likely to earn on the state examination for obstetrical nursing. The grade earned in Nursing 206 can be used to predict the minimum or maximum score on the state examination for the nursing of children. Similarly, the grade point average for Nursing 105, Nursing 204 and Nursing 205 can be used to predict the average score a graduate will earn on the state examination for the three subtests, Medical Nursing, Psychiatric Nursing, and Surgical Nursing. (See tables 11, 12 and 13).

TABLE 11

Nursing Graduates

Regression Formulas Used to Predict Results of the State Board Examination Subtests

| Nursing Course(s) at Macomb | Formula<br>Replace N with the Number of Honor Points or the Grade Point Average Earned | Standard Error of the Estimate |
|---|---|---|
| Nursing 104 | $525^1 + 81\ (N - 3.59^1)$ = Predicted Score for Subtest OBS NSG | 87.50 |
| Nursing 206 | $583^1 + 62\ (N - 3.28^1)$ = Predicted Score for Subtest NSG CHL | 85.59 |
| Nursing 105, Nursing 204, and Nursing 205: Taken Together | $535^1 + 1.1\ (N - 3.20^1)$ = Predicted Score for Subtests MED NSG, PSY NSG, and SURG NSG: Taken Together | 89.51 |

[1]Mean values of the sample.

TABLE 12

Nursing Graduates

Predicted Minimum and Maximum Scores on the
State Board Examination Subtests for Selected Grades Earned at Macomb

| Nursing Course(s) at Macomb | Grade or Grade Point Average Earned | Predicted Range of Scores | | State Examination Subtests |
|---|---|---|---|---|
| | | Minimum Score | Maximum Score | |
| Nursing 104 | D | 227 | 402 | Obstetrical Nursing |
| | C | 308 | 483 | |
| | B | 389 | 564 | |
| | A | 470 | 645 | |
| Nursing 206 | D | 355 | 527 | Nursing of Children |
| | C | 418 | 589 | |
| | B | 480 | 651 | |
| | A | 542 | 700 | |
| Nursing 105, Nursing 204 and Nursing 205: Taken Together | 2.00 | 334 | 473 | Medical Nursing, Psychiatric Nursing, and Surgical Nursing: Taken Together |
| | 2.33 | 371 | 509 | |
| | 2.67 | 408 | 546 | |
| | 3.00 | 444 | 583 | |
| | 3.33 | 481 | 619 | |
| | 3.67 | 518 | 656 | |
| | 4.00 | 554 | 693 | |

TABLE 13

Nursing Graduates

Probabilities of Passing State Board Examination Subtests

| Subtest(s) | Corresponding Nursing Course(s) at Macomb | Grade or Grade Point Average Earned in Macomb Nursing Course(s) | Probability of Passing Subtest (Score or average Score of 350 or Higher) |
|---|---|---|---|
| Obstetrical Nursing | Nursing 104 | D | 34% |
| | | C | 70% |
| | | B | 93% |
| | | A | 99% |
| Nursing of Children | Nursing 206 | D | 86% |
| | | C | 96% |
| | | B | 99% |
| | | A | 99.9% |
| Medical Nursing, Psychiatric Nursing and Surgical Nursing: Taken Together | Nursing 105, Nursing 204, and Nursing 205: Taken Together | 2.00 | 78% |
| | | 2.33 | 90% |
| | | 2.67 | 97% |
| | | 3.00 | 99% |
| | | 3.33 | 99.8% |
| | | 3.67 | 99.9% |
| | | 4.00 | 99.9+% |

Considering only female nursing graduates, five dependent variables can be used to predict the average score a graduate is likely to earn on the state examination: (1) the student's marital status, (2) her age, (3) her composite ACT score. (4) the grade she earned in college-level anatomy and physiology, and (5) her final grade point average at Macomb.

Table 14 gives the regression formulas that were used to make predictions of the average score a female graduate would earn on the state examination. Tables 15 to 19 show the predicted ranges into which the average scores will fall for selected values of admissions characteristics. These tables also show the probability that a graduate's will earn an average score of 350 or higher for each of these values. A score below 350 on any subtest constitutes failure of the examination.

TABLE 14

Female Nursing Graduates

Regression Forumlas Used to Predict the Average Score on the State Board Examination

| Dependent Variables | Formula<br>Replace N with the value of the Admissions Characteristic (See Tables 3 and 4) | Standard Error of the Estimate |
|---|---|---|
| Marital Status | $551^1 + 70\ (N - .66^1)$ = Predicted Average Score | 73.89 |
| Age | $547^1 + 3.68\ (N - 28.1^1)$ = Predicted Average Score | 81.61 |
| Composite ACT Score | $545^1 + 4.83\ (N - 16^1)$ = Predicted Average Score | 65.06 |
| Grade Earned in College-level Anatomy and Physiology | $547^1 + 61.21\ (N - 2.95^1)$ = Predicted Average Score | 73.81 |
| Final Grade Point Average at Macomb | $547^1 + 1.27\ (N - 3.30^1)$ = Predicted Average Score | 34.46 |

[1]Mean values of the sample.

TABLE 15

Female Nursing Graduates

Predictions and Probabilities
Based on Marital Status

| Marital Status | Predicted Range of Average Scores | | Probability of Earning an Average Score of 350 or Higher |
|---|---|---|---|
| | Minimum | Maximum | |
| Single | 431 | 579 | 98% |
| Married | 501 | 649 | 99.9% |

TABLE 16

Female Nursing Graduates

Predictions and Probabilities
Based on Age

| Age | Predicted Range of Average Scores | | Probability of Earni an Average Score o 350 or Higher |
|---|---|---|---|
| | Minimum | Maximum | |
| 18 | 428 | 591 | 97.4% |
| 20 | 435 | 598 | 97.9% |
| 22 | 443 | 606 | 98.3% |
| 24 | 450 | 613 | 98.6% |
| 26 | 457 | 621 | 98.9% |
| 28 | 465 | 628 | 99.1% |
| 30 | 472 | 635 | 99.4% |
| 32 | 479 | 643 | 99.5% |
| 34 | 487 | 550 | 99.6% |
| 36 | 494 | 657 | 99.7% |

TABLE 17

Female Nursing Graduates

Prediction and Probabilities Based on Composite ACT Scores

| Composite ACT Scores | Predicted Range of Average Scores | | Probability of Earning an Average Score of 350 or Higher |
|---|---|---|---|
| | Minimum | Maximum | |
| 1 | 409 | 539 | 97.1% |
| 2 | 414 | 544 | 97.6% |
| 3 | 419 | 549 | 98.0% |
| 4 | 424 | 554 | 98.3% |
| 5 | 428 | 559 | 98.6% |
| 6 | 433 | 563 | 98.9% |
| 7 | 438 | 568 | 99.0% |
| 8 | 443 | 573 | 99.2% |
| 9 | 448 | 578 | 99.3% |
| 10 | 453 | 583 | 99.5% |
| 11 | 457 | 588 | 99.6% |
| 12 | 462 | 592 | 99.7% |
| 13 | 467 | 597 | 99.7% |
| 14 | 472 | 602 | 99.8% |
| 15 | 477 | 607 | 99.8% |
| 16 | 482 | 612 | 99.8% |
| 17 | 486 | 617 | 99.9% |
| 18 | 491 | 621 | 99.9+% |
| 19 | 496 | 626 | 99.9+% |
| 20 | 501 | 631 | 99.9+% |
| 21 | 506 | 636 | 99.9+% |
| 22 | 511 | 641 | 99.9+% |
| 23 | 515 | 646 | 99.9+% |
| 24 | 520 | 650 | 99.9+% |
| 25 | 525 | 655 | 99.9+% |
| 26 | 530 | 660 | 99.9+% |

TABLE 18

Female Nursing Graduates

Predictions and Probabilities Based on Grades Earned in College-level Anatomy and Physiology

| Grade Earned in College-level Anatomy and Physiology | Predicted Range of Average Scores | | Probability of Earni an Average Score o 350 or Higher |
|---|---|---|---|
| | Minimum | Maximum | |
| D | 352 | 502 | 85% |
| C | 415 | 563 | 97% |
| B | 476 | 624 | 99.6% |
| A | 538 | 685 | 99.9% |

TABLE 19

Female Nursing Graduates

Predictions and Probabilities Based on the Final Grade Point Average at Macomb

| Final Grade Point Average at Macomb | Predicted Range of Average Scores | | Probability of Earning an Average Score of 350 or Higher |
|---|---|---|---|
| | Minimum | Maximum | |
| 2.0 | 315 | 443 | 68% |
| 2.5 | 379 | 506 | 93% |
| 3.0 | 442 | 570 | 99.3% |
| 3.5 | 506 | 634 | 99.9% |
| 4.0 | 570 | 697 | 99.9% |

Two admissions characteristics can be used to predict a female graduates' final grade point average at Macomb: her high school grade point average and the grade she earns in college-level Anatomy and Physiology. (See Tables 20 and 21)

TABLE 20

Female Nursing Graduates

Regression Formulas Used to Predict Final Grade Point Averages at Macomb

| Admissions Characteristics | Formula<br>Replace N with the Grade Point Average or the Number of Honor Points Earned | Standard Error of the Estimate |
|---|---|---|
| High School Grade Point Average | $3.29^{1} + 0.44\ (N - 3.05^{1}) =$ Predicted Final GPA | 0.38 |
| Grade Earned in College-level Anatomy and Physiology | $3.32^{1} + 0.44\ (N - 2.95^{1}) =$ Predicted Final GPA | 0.32 |

[1]Mean values of the sample.

TABLE 21

Female Nursing Graduates
Predicted Final Grade Point Averages at Macomb
for Selected Values of Admissions Characteristics

| Admissions Characteristic | Selected Values | Predicted Range | |
|---|---|---|---|
| | | Minimum | Maximum |
| High School Grade Point Average | 1.5 | 2.23 | 2.98 |
| | 2.0 | 2.44 | 3.20 |
| | 2.5 | 2.67 | 3.42 |
| | 3.0 | 2.89 | 3.65 |
| | 3.5 | 3.11 | 3.87 |
| | 4.0 | 3.34 | 4.00 |
| Grade Earned in College-level Anatomy and Physiology | D | 2.14 | 2.78 |
| | C | 2.58 | 3.22 |
| | B | 3.02 | 3.67 |
| | A | 3.47 | 4.00 |

In this report success has been measured in three ways. It should be noted now that the grade earned in college-level anatomy and physiology is the sole predictor of all three measures. Furthermore, that grade is the most reliable predictor of any of those examined.

## RECOMMENDATIONS FOR FURTHER STUDIES

It is possible that those factors considered in this study that were not linearly related are significantly related in a non-linear fashion. However, the valid use of the statistical tools needed to reveal these relationships requires complete sets of information.

If all of the data concerning nursing students were collected at the time of enrollment in the program, future studies of this type could be done using these tools.

A computer file containing the necessary data might provide an efficient method for storing the data, for protecting against the loss of data, and for saving valuable time when future studies are undertaken.

Other admissions characteristics and other measures of performance, not considered here due to the unavailability of data, could also be included.

It might be interesting to duplicate this study for another class at Macomb in order to test the reliability of the results of this study. Moreover, it might be revealing to do a similar study of nursing graduates at another community college in Michigan.

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